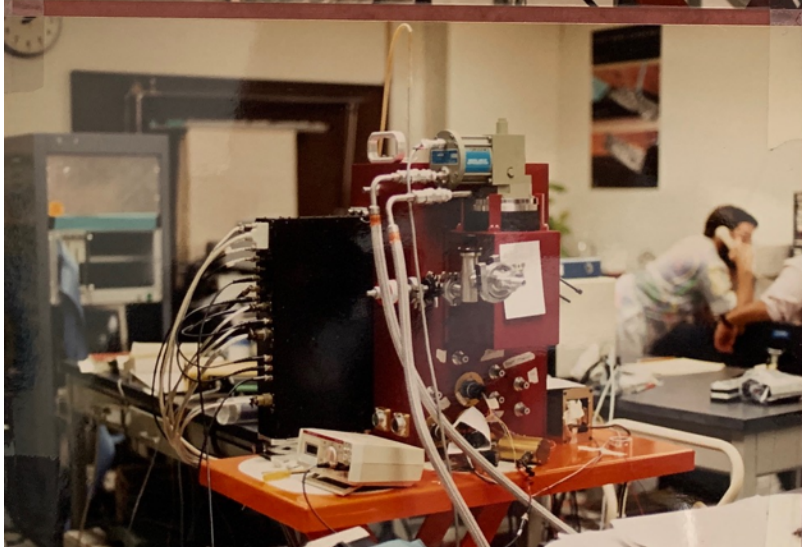




Precise Binary Orbits with NPOI & CSHELL

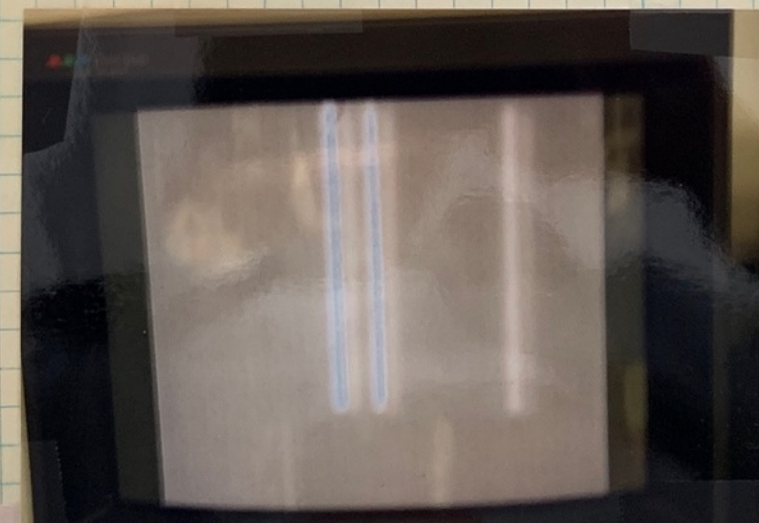
Lisa Prato — Lowell Observatory / NAU — March 19, 2019

Once upon a time (1991) there was a little infrared, high-resolution spectrograph...

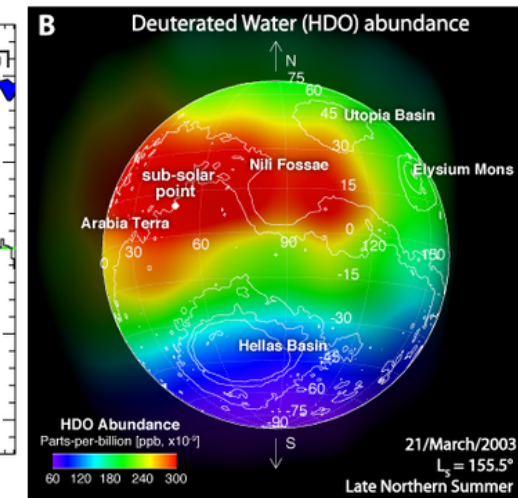
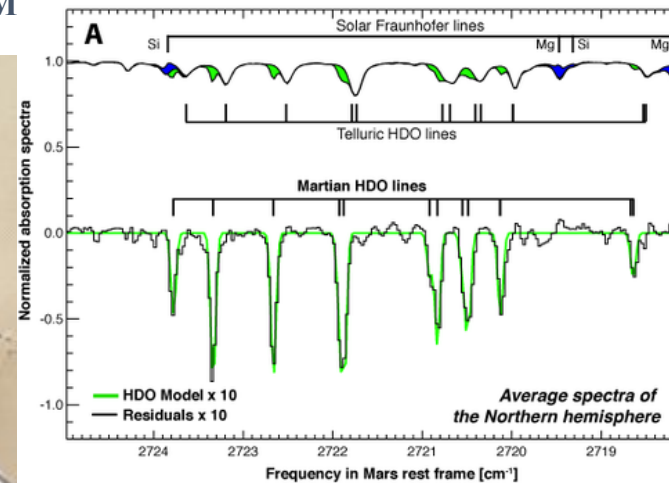
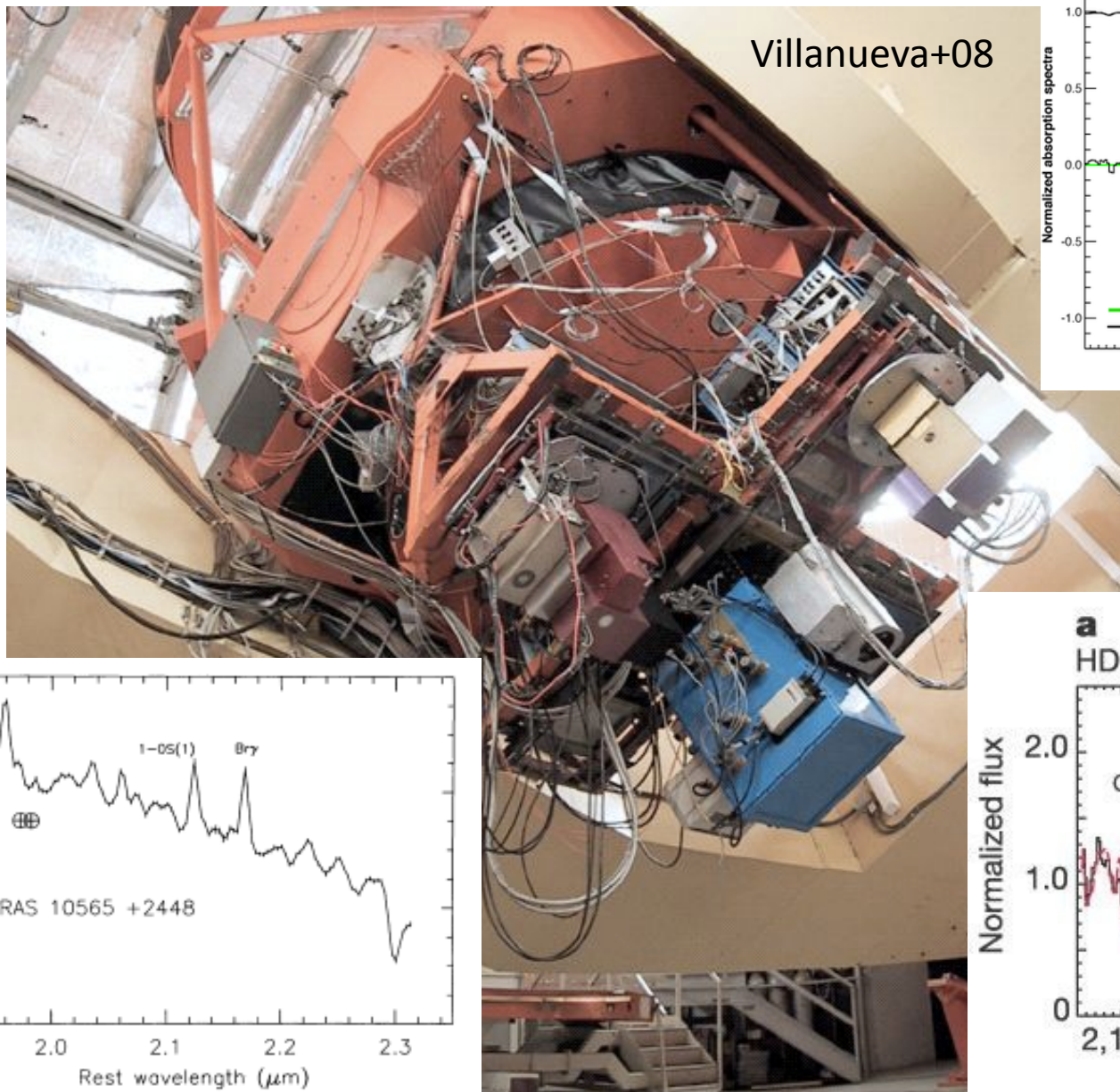


FIRST SPECTRUM
~ MAY 1991

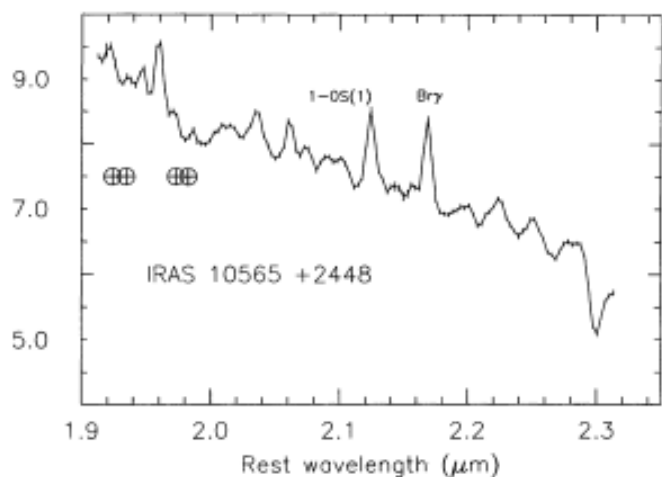
CSHELL first light in
lab at the IfA, 1991:
John Carr and
Alan Tokunaga



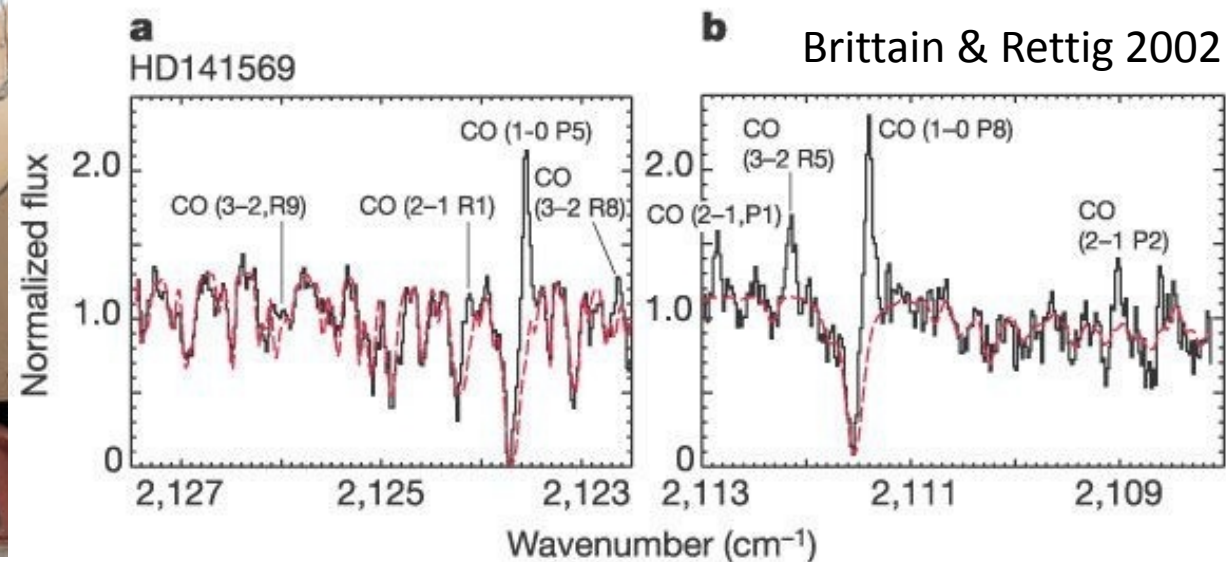
Villanueva+08



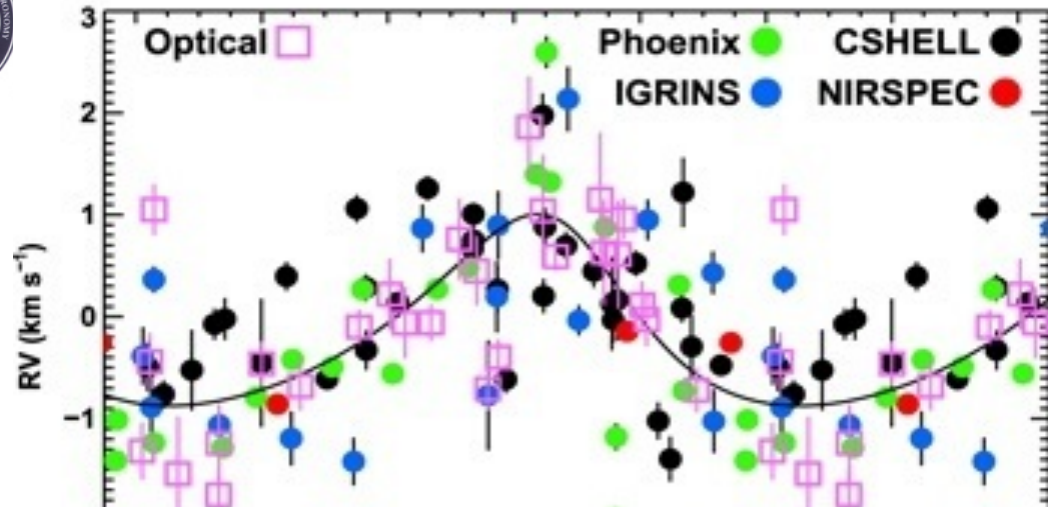
Solar system, stellar, galactic, & extra-galactic science with CSHELL: 1992—2016



Goldader+95

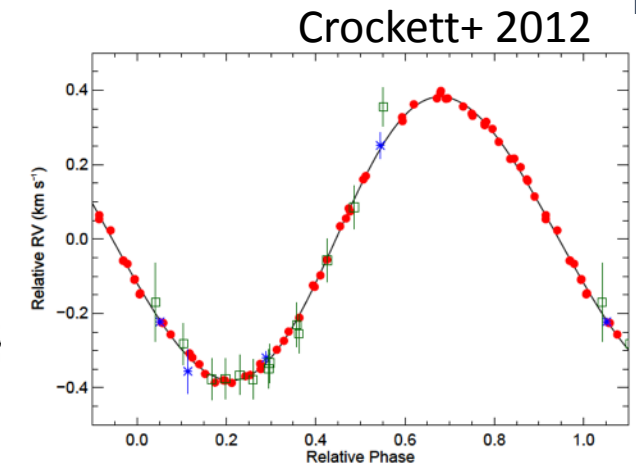
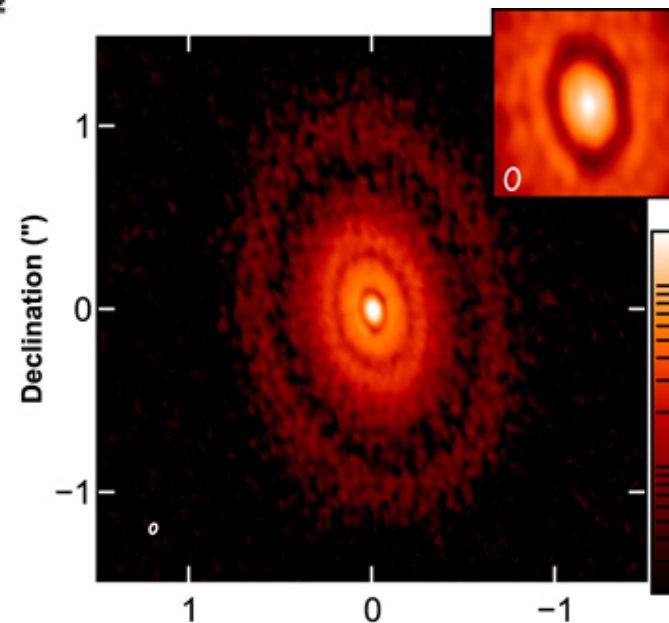
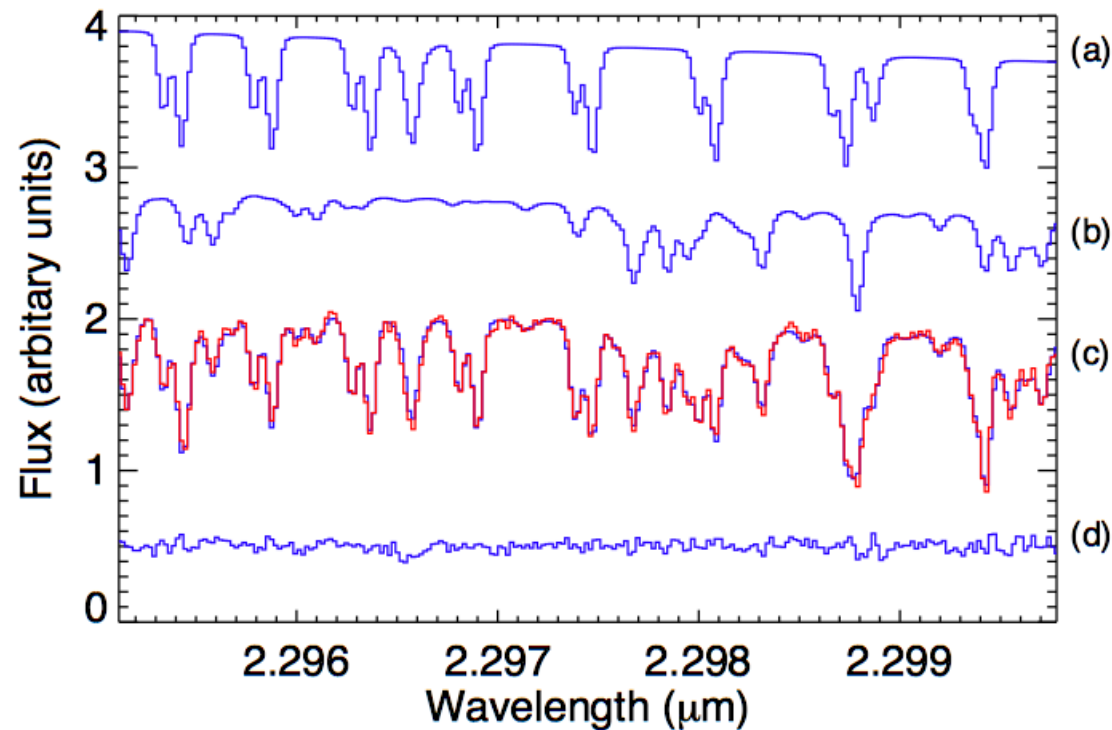


Brittain & Rettig 2002



Johns-Krull et al. 2016: CSHELL helps to identify very young planet around a classical T Tauri star!

Russel White, Peter Plavchan, Peter Gao and others applied the same approach to other exoplanet searches w/ CSHELL. Plavchan & Gao installed a gas cell and found precisions of a few meters/second for bright stars (e.g., Gao+ 2016)



Clark+ 2018



March, 2018

“I got an email from Xxxxx Zzzzz a couple for days ago asking again if his group can have CSHELL on loan. You get first refusal.”

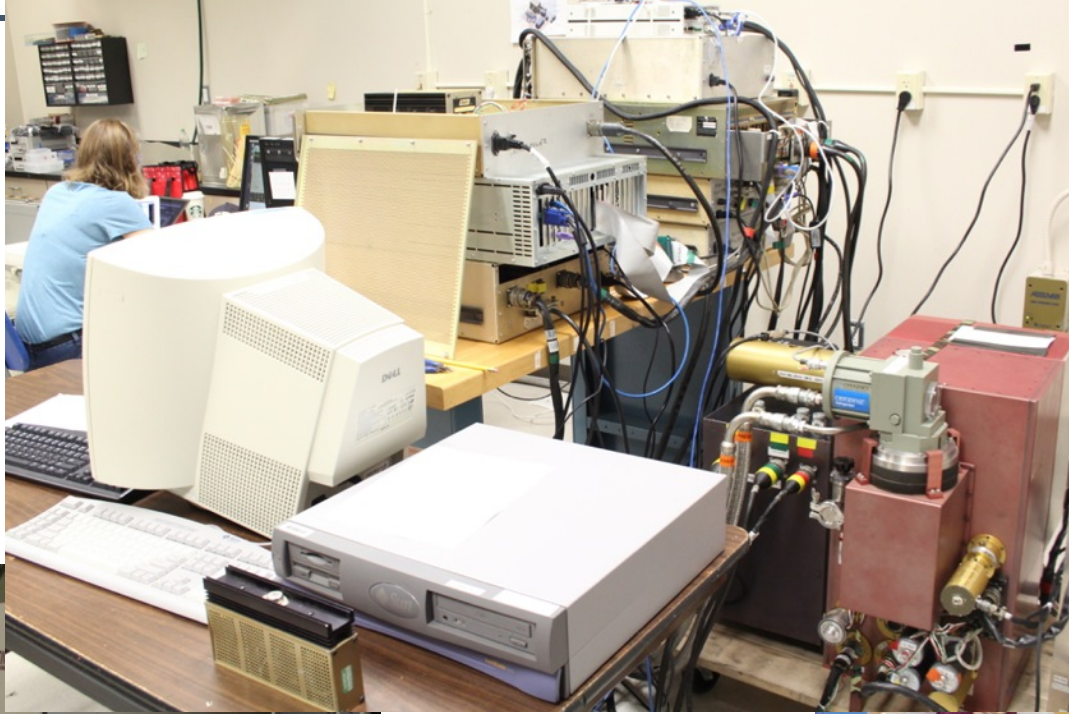
....

May, 2018

“The day crew are in the process of building a counter-weight to replace CSHELL on the telescope...”

--

John Rayner
Director, NASA Infrared Telescope Facility



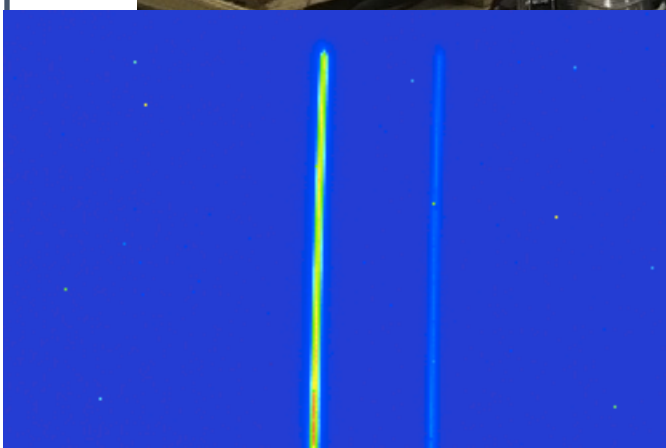
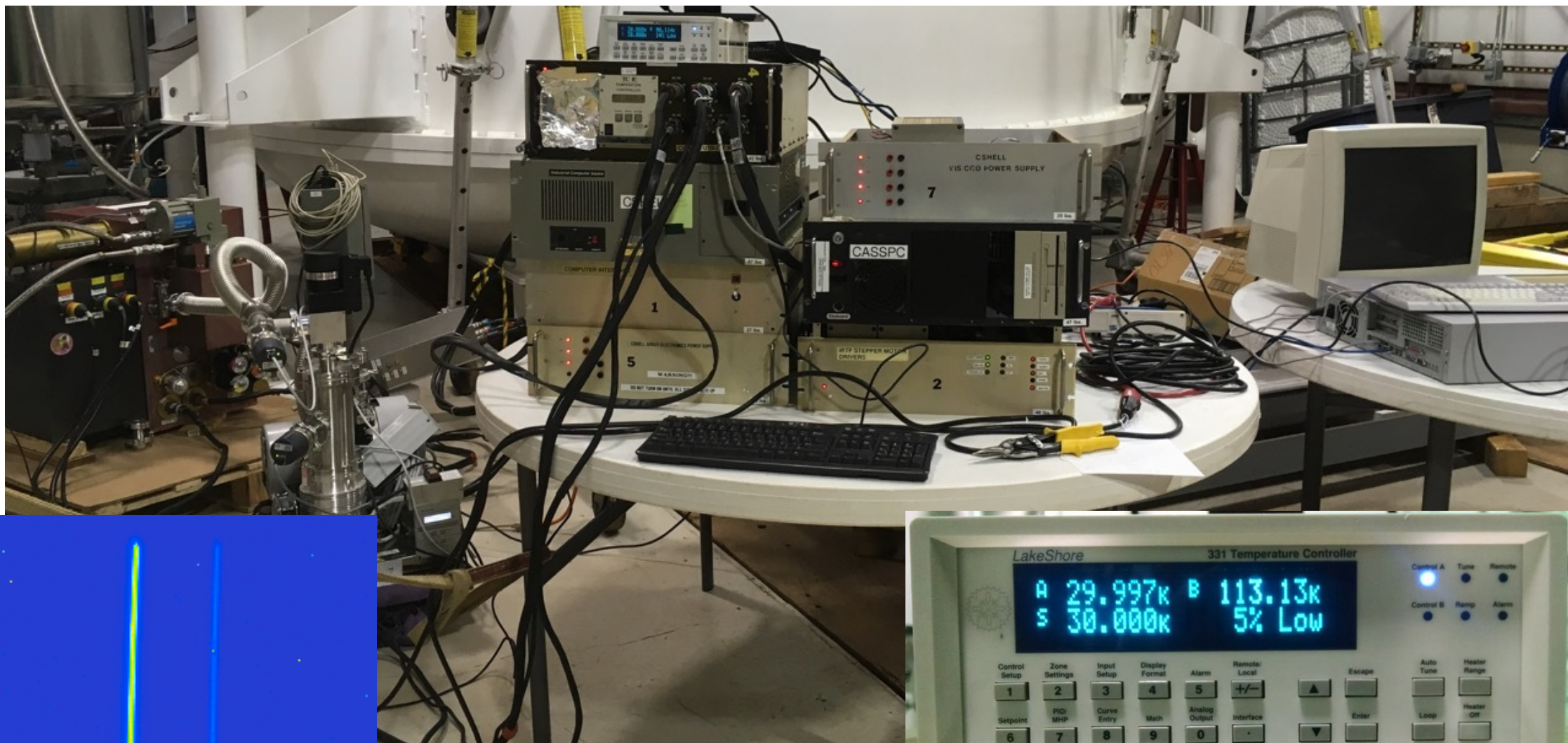
Hilo: packed up CSHELL in July, 2018



Shipped:
November 2018



It's alive after shipping!! detector cooled to 30 K after <29 hours on He compressor, March 17, 2019





CSHELL Specs

IRTF 3-meter: K ~ 8 mag S/N ratio ~ 100 in 1 hour

0.95—5 micron grasp

R $\sim 45,000$ (~ 7 km/s/resolution element) max

Oversampled by ~ 3 pixels/resolution element

On a 1-meter telescope: need bright things!

K ~ 6 mag S/N ratio ~ 100 in 3 hours

hmmmmmm.... what to do
what to do with a high-R IR
spectrograph and where to
find a 1-meter telescope...

CSHELL Specs

IRTF 3-meter: K ~ 8 mag S/N ratio ~ 100 in 1 hour

0.95—5 micron grasp

R $\sim 45,000$ (~ 7 km/s/resolution element) max

Oversampled by ~ 3 pixels/resolution element

On a 1-meter telescope: need bright things!

K ~ 6 mag S/N ratio ~ 100 in 3 hours

Variability of red supergiants!

RV followup for TESS!

**Spectroscopic binary
orbits on relatively
bright stars!**





Now all we need is an interferometer!

CSHELL Specs

IRTF 3-meter: K ~ 8 mag S/N ratio ~ 100 in 1 hour

0.95—5 micron grasp

R $\sim 45,000$ (~ 7 km/s/resolution element) max

Oversampled by ~ 3 pixels/resolution element

On a 1-meter telescope: need bright things!

K ~ 6 mag S/N ratio ~ 100 in 3 hours





NPOI Specs

Current 100-meter baseline: 0.35 mas

V ~5.5 mag

New 432-meter baseline: 80 uas

V ~9 mag

K7 star: V—K ~3 mag

well-matched to K ~6 mag!

G0	1.41
G2	1.46
G4	1.53
G6	1.64
K0	1.96
K2	2.22
K4	2.63
K5	2.85
K7	3.16
M0	3.65
M1	3.87
M2	4.11
M3	4.65
M4	5.28
M5	6.17
M6	7.37

Tokunaga 2007

And incidentally.....

CHARA could provide K mags
yielding component V—K colors
as well as orbits for K ~6 mag
and brighter targets!





TO DO:

- ** negotiate a potential plan for 42" (telescope usage, load, mounting, baffling, instrument changes, etc)
 - ** explore possibility of detector upgrade
 - ** investigate feasibility of a 1.5-meter PlaneWave???!!!
 - ** pursue funding opportunities for dual RV + Interferometry
- strategic use of resources



KUDOS*KUDOS*KUDOS*KUDOS*KUDOS

Lars Bergknut

John Rayner

Alan Tokunaga

Stephen Levine

Frank Cornelius

Teznie Pugh

Joe Llama



Potential acronym: C-FINO (CSHELL-Fortytwo Inch+NPOI)